


FIVE-YEAR REVIEW REPORT
FOR
GALENA SUBSITE - OPERABLE UNIT #01
ALTERNATE WATER SUPPLY
CHEROKEE COUNTY SUPERFUND SITE
CHEROKEE COUNTY, KANSAS

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SEPTEMBER 1995


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9/28/95
Date

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1.0 INTRODUCTION

This report documents the five-year review of the Galena Subsite, Operable Unit (OU) #01, Alternate Water Supply, of the Cherokee County Superfund Site in Cherokee County, Kansas. This review was conducted by the U.S. Environmental Protection Agency (EPA).

The purpose of the five-year review is to determine the continued adequacy of remedial response actions undertaken at the site to protect human health, welfare, and the environment. Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require that periodic (at least once every five years) reviews be conducted for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use or unrestricted exposure following the completion of all remedial actions for the site. The reviews are to be completed within five years of initiation of the first remedial action at a site or a specific operable unit within a site. Remedial activities at the Galena Subsite OU#01, Alternate Water Supply, of the Cherokee County Superfund Site began in September 1989 when the EPA's contractor mobilized to start construction of the remedial action. OU#01 was completed as a Fund-Lead Remedial Action.

The EPA has established four levels of review. Level III requires the most in-depth review and would be appropriate for sites where there is the greatest likelihood that the remedial actions are no longer protective of human health, welfare, and the environment. Level II is a less intensive review, and Level I is appropriate for sites where the remedial actions are anticipated to have been adequately protective of human health, welfare, and the environment during the first five years of implementation. A Type Ia review is intended to streamline the five-year review process at sites where remedial action is ongoing and to reduce resource needs for such reviews. A Type Ia review is a modified version of a Type I review. A Type Ia emphasizes only relevant protectiveness factors, analyzed at a standard of review appropriate for sites where response is ongoing. Sites generally qualify for a Type Ia review until construction is completed and the site qualifies for listing on the Construction Completion List.

A Level I review was conducted at the Galena Subsite OU#01, Alternate Water Supply, of the Cherokee County Superfund Site because the remedial actions appear to be adequate and fully implemented. This five-year review report summarizes remedial actions undertaken at the site to date, and will determine if the remedial actions are achieving the goal of protecting human health, welfare, and the environment.

The five-year review included a site visit conducted on July 19, 1995, to observe the current site conditions and the current remedial actions. The site visit was conducted by Mark Doolan and Dave Drake, both with EPA Region VII.

2.0 SITE BACKGROUND

2.1 Site Location and Description

The Cherokee County Superfund Site represents the Kansas portion of the Tri-State Mining District. The Tri-State District encompasses approximately 500 square miles in Oklahoma, Kansas, and Missouri, and was formerly one of the richest lead and zinc ore deposits in the world. The Kansas portion of the district lies within the extreme southeast corner of the state.

Because of the large size of the mining district in Kansas, the Cherokee County Superfund Site has been divided into six subsites. The subsites are the Galena area, the Baxter Springs area, the Treece area, the Badger area, the Lawton area, and the Waco area. These six subsites encompass most of the area where mining occurred within the Cherokee County Superfund Site, and where physical surface disturbances are still evident.

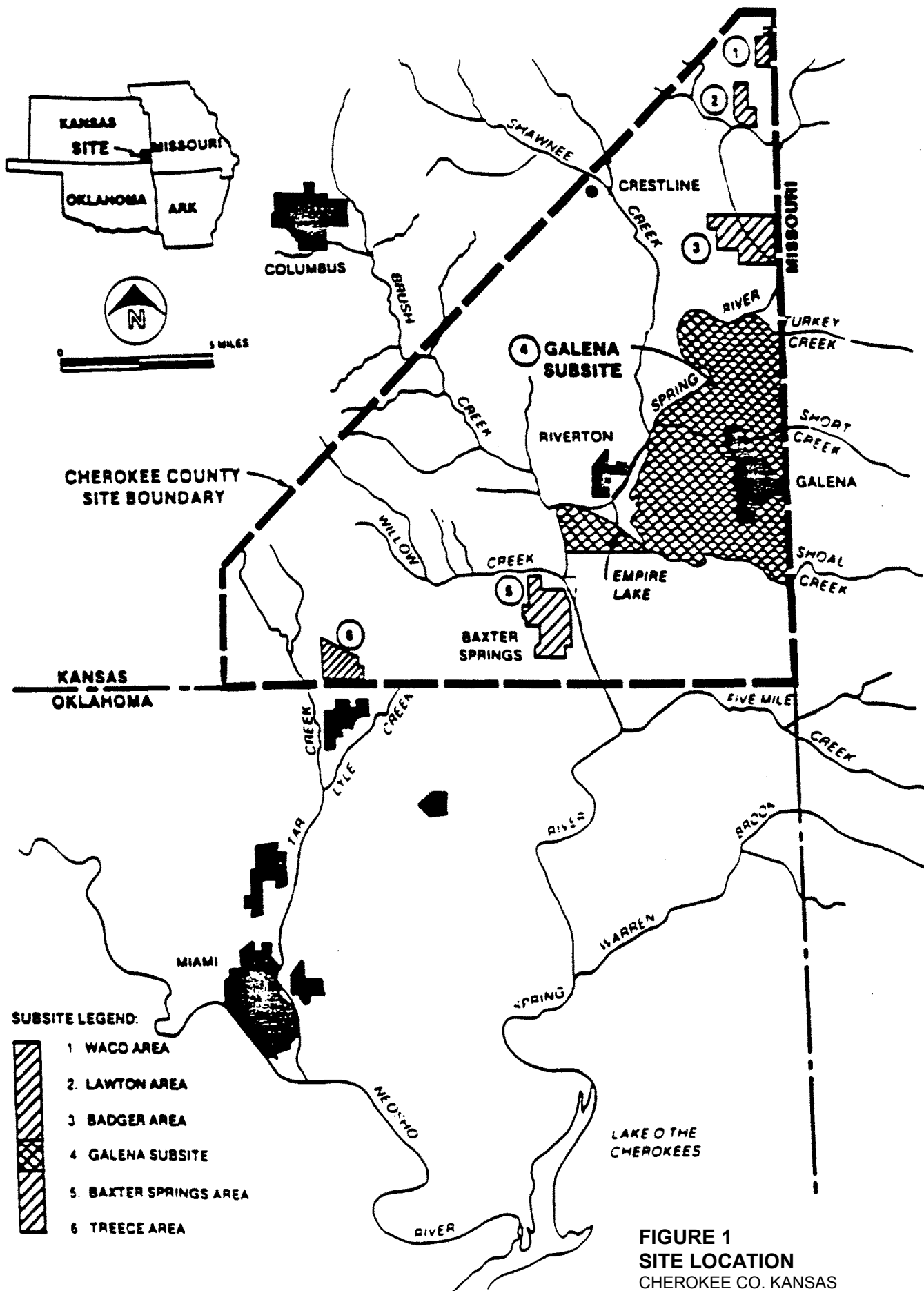
The Galena subsite is located in the east-central portion of the Cherokee County Superfund Site (see Figure 1). The City of Galena, a residential community of 3,588, lies near the center of the subsite. The Galena subsite is located on the western edge of the Central Lowlands Physiographic Province and is characterized by gentle slopes and shallow stream valleys much of which is used as cropland. The mining district is characterized by surface mine waste features, abandoned tailings ponds, both open and collapsed mine shafts, and surface subsidence features. The mine waste areas contain sparse to no vegetation. Many houses are immediately adjacent to mine waste piles and are located within areas of eolian deposited smelter wastes.

Two operable units have been created within the Galena subsite, the Alternate Water Supply Operable Unit (#01) and the Ground Water/Surface Water Operable Unit (#05). Both OUs address the same subsite area. OU#01 was implemented to provide a safe drinking water source for rural residents outside the City of Galena, Kansas. OU#05 was implemented to address the human health and environmental risks associated with the mining waste contaminants. This report will address only remedial activities associated with OU#01.

2.2 Site History

Lead and zinc mining began in the Galena area about 1875 and continued into the 1920's. A smelter operated along Short Creek directly north of town from the 1890's until the early 1960's. Sphalerite (zinc sulfide) and galena (lead sulfide) were the principle ores, although several other metal sulfides were found in association with the economic ores.

The mining activities changed the hydrology of the area by creating underground voids, which cause subsidence resulting from conduit or fracture flow, and leaving mine wastes on the surface. These actions disrupted the normal surface drainage and depleted surface vegetation, thereby increasing infiltration of surface water into the shallow ground water system. An



estimated 2.0 million cubic yards of mine voids within the Galena subsite remain open to the surface. During the active mining years, water was continually pumped out of the mines because the ore is located in the same rock formations that contain the area's shallow aquifer. When mining ceased, the mines filled with water as a result of natural ground water recharge and surface water inflow through mine shafts and subsidence areas.

Today, the Galena area is underlain by abandoned mines and surrounded by large areas of mining-related wastes. An estimated 1.5 million cubic yards of these mine-related wastes are present within the Galena subsite. Numerous subsidence features and open mine shafts, many filled with water, are present in and around the town of Galena.

The Cherokee County Superfund Site was proposed for the National Priority List (NPL) in December 1982 and finalized on the NPL in September 1983. In 1983, the EPA initiated a Remedial Investigation/Feasibility Study (RI/FS). As part of this study, the EPA discovered that several private drinking water wells outside of Galena, Kansas contained levels of lead, cadmium, chromium, and nickel above the maximum contaminant levels (MCLs) considered safe for drinking purposes under the Safe Drinking Water Act. Additionally, secondary MCLs or MCL goals were exceeded for zinc and manganese. The EPA immediately provided those residents with treatment units for their private wells until a permanent remedy could be implemented. Findings from these studies indicated that the shallow aquifer, which was utilized as the sole source of drinking water by rural area residents outside the Galena city limits, had become contaminated by heavy metals.

2.3 Community Relations

Community and Congressional interest regarding EPA's activities at the site have been high. Public meetings have been held on a continuing basis throughout the ongoing activities conducted at this site.

A group of legislators formed a task force to help assist coordination of activities at the Cherokee County Superfund Site. The task force is made up of 22 people, including the Lieutenant Governor, four State Senators and Representatives, a U.S. Representative and people representing the City of Galena, Cherokee County, Kansas National Guard, Kansas Department of Health and Environment (KDHE), Kansas Mined Lands Conservation and Reclamation Board, Kansas Water Office, U.S. Bureau of Mines, U.S. Office of Surface Mining, U.S. Soil Conservation Service, EPA and citizens.

2.4 Description of Contaminants

The primary source of contamination at the Galena and other five subsites is the residual metal sulfides in the abandoned mine workings, waste rock and chat piles. Upon exposure to the atmosphere, these metal sulfides can become oxidized and mobilize as dissolved compounds which increases acidity. The resulting metal-laden acidic water, referred to as acid mine drainage,

can further leach metals from rock, contaminate ground water and fill mine shafts and subsidence areas. The acid mine drainage can also surface through springs and combine with metal-laden surface water runoff and ultimately contaminate rivers, creeks, and lakes. The shallow aquifer, from which the rural Galena residents obtain their drinking water through private wells, has been contaminated by acid mine drainage. The major contaminants and maximum concentrations identified in the ground water prior to any treatment or construction activities were as follows:

	<u>Concentration</u>	<u>Criteria</u>
Cadmium	180 ug/l	5 ^a
Chromium	120 ug/l	100 ^a
Lead	230 ug/l	15 ^b
Manganese	3,400 ug/l	200 ^c , 50 ^d
Nickel	270 ug/l	100 ^a
Zinc	15,000 ug/l	5,000 ^d

^aMCL

^bAction Level

^cMCLG

^dSecondary MCL

ug/l = micrograms per liter or parts per billion (ppb)

3.0 SELECTED REMEDY

In order to expedite an action to provide a safe drinking water source for the Galena, Kansas area residents, the EPA provided for an initial action under the Alternate Water Supply OU#01. Subsequent OUs were planned to address the mine waste areas in Galena and other concerns. This allowed EPA to address the most immediate threat and provide the residents with a good source of drinking water while investigations of the source areas in Galena and other subsites were ongoing. OU#01, which this report addresses, provides a safe water supply for the rural Galena residents. OU#02 was proposed to address concerns with the Spring River but has since been discontinued and incorporated into the other operable units. OU#03 will address the source control, ground water and surface water concerns with the Baxter Springs and Treece subsites and is being addressed as one project. The Treece subsite was initially designated as OU#04 but was later combined with the Baxter Springs subsite and designated as OU#03. OU#05 addresses the source control, ground water and surface water concerns at the Galena subsite as a follow-up to the OU#01 remedy. OU#06 will address the source control, ground water and surface water concerns with the Badger, Lawton and Waco subsites.

The OU#01 remedy consists of providing a separate water supply for the rural residents of Galena, Kansas. The original remedy as outlined in the 1987 Record of Decision (ROD) was to collect water from the deeper uncontaminated Roubidoux aquifer through existing wells owned by the City of Galena and distribute the water through a pipeline network to homes and businesses

within the subsite, but outside of the current Galena municipal water system. Two city wells would have been rehabilitated to provide the necessary water or a new well would have been drilled if the existing wells could not have been rehabilitated. The wells' chlorination system and distribution system within the City of Galena would be operated and maintained by the City of Galena. The water distribution system outside the City of Galena would be operated by an entity selected by the citizens in the new service area.

However, the local residents voiced much concern with this idea stating they would prefer the creation of a water source independent from the City of Galena. Therefore, a new rural water district was formed, Kansas Rural Water District (RWD) #8, and an explanation of significant differences (ESD) was written to modify the 1987 ROD. The ESD, finalized in July 1989, added an additional area north of Galena to the Galena subsite and modified the remedy. One or more deep wells would be constructed and maintained independent from the City of Galena. As an exception, the City of Galena would provide water to residences on the southeastern edge of the city in areas not currently serviced as well as for two other residents in close proximity to the city distribution system. The reason for these exceptions is that these areas were isolated from the remainder of the service area and it would have been uneconomical to extend service lines to these areas from the new independent system.

3.1 Remedial Goals

The primary goal of the operable unit remediation is to provide suitable drinking water to the population within the Galena subsite. Suitable drinking water is water that meets the primary MCLs, 40 C.F.R §141, as set by the Safe Drinking Water Act, 42 U.S.C. §1412 at existing water taps. In addition, Kansas Safe Drinking Water Standards, KAR 23-15-1 through -10 should be met to provide safe and suitable drinking water. A second indirect, but equally important goal, is to protect the deep aquifer from contamination that could occur as a direct or indirect result of implementing an alternative water supply. These goals are compatible with overall site-wide and subsite remediation goals.

3.2 Chronology of Events

December 21, 1987	Record of Decision for the Alternate Water Supply Operable Unit (#01) signed, outlining the idea to provide a new water supply to rural Galena, Kansas residents.
February 1988	The United States Army Corps of Engineers (COE) was given notice to proceed with the remedial design for the alternate water supply.
March 1989	A new Kansas Rural Water District #8 was incorporated in order to operate and maintain a new alternate water supply system for the rural residents near Galena, Kansas.

July 1989	The first phase of the remedial design was completed. This phase addressed the construction of two water storage tanks and the drilling of two water supply wells.
July 27, 1989	The Explanation of Significant Differences was finalized reflecting the modifications to the selected remedy. A water source independent from the City of Galena would be developed and a new rural water district was formed to maintain the system.
September 1989	Construction activities began on the water tanks and drilling activities began on the water supply wells. Pitt-Des Moines Company was awarded the water tank construction contract and Larson Drilling Company was awarded the contract to drill the two new wells.
September 1990	Construction of the two water storage tanks was completed. One water tank has a 400,000 gallon capacity and the second a 50,000 gallon capacity.
December 1990	Construction of the two new water supply wells was completed. Both wells were drilled to a depth of approximately 1,100 feet. The upper 500 feet of each well was cased to protect the deep aquifer from the shallow aquifer contamination derived from the acid mine drainage.
April 1991	Construction of the water distribution system began. The contract was awarded to Slates Construction Company.
May 1993	292 homes were attached to the water supply system as outlined by the original water distribution contract. The Rural Water District #8 began billing rural residents for water. Individual treatment units were discontinued when homes were attached to the new water supply system.
August 1993	The water distribution contract was modified to add 112 new homes to the water system.
December 1993	Construction was completed with 404 users attached to the water supply system. Over 57 miles of water line was constructed.
January 1994	Final Inspection was performed. A punch list was identified of minor items to be completed prior to contract completion.

4.0 SUMMARY OF RESPONSE ACTIONS

4.1 Construction Activities

Construction activities were performed under a phased approach to expedite installation of the water system and to minimize project cost. The COE acted as the construction manager and used contractors to implement the major phases of the work: water tank construction, water supply well drilling, and water distribution construction. The technical and contractual aspects of the work were defined in contract document packages prepared by Bartlett & West, the remedial design contractor, during the design phase. The contractor documents were reviewed by EPA, the KDHE, and RWD #8 prior to release for bidding. All contractors were selected on the basis of competitive bidding in accordance with the Federal Acquisition Requirements (FARs) to control cost.

4.2 Water Tanks

Pitt-Des Moines Company was contracted to construct the two water tanks for the water supply system. The COE provided oversight for the construction activities. Two water supply tanks were constructed. The main tank was a 400,000 gallon capacity unit and is located immediately adjacent to the operation and maintenance building southwest of downtown Galena. A smaller 50,000 gallon capacity tank was constructed north of Galena. Tank construction began in September 1989 and was completed in September 1990.

4.3 Water Supply Wells

Two water supply wells were drilled to provide the water for the system. Larson Drilling Company was contracted to drill the two wells. Again, the COE provided oversight of the drilling activities. Both wells were drilled to a depth of approximately 1,100 feet into the deep Roubidoux aquifer. The wells were cased to approximately 500 feet below grade in order to protect the deep uncontaminated aquifer from the shallow aquifer contamination. Both wells are located southwest of Galena. Well construction began in December 1989 and was completed in December 1990.

4.4 Water Distribution System

The Water distribution system was constructed by Slates Construction Company with oversight by the COE. Fifty-seven miles of water line was constructed along with two pumphouses, one booster pump station, and one operation and maintenance building. At the end of the construction, 404 total users were attached to the water system and 43 additional meter stubs were placed. The meter stubs were placed on private property to allow for later hookup to a home or business. The meter stubs were installed at the request of the local residents. The water distribution construction was initiated in April 1991 and completed in December 1993. Currently, there are 447 users and a number of available meter stubs.

5.0 CURRENT CONDITIONS

The rural water district is currently operational and adequately providing drinking water to users. However, as noted during a July 1995 site visit, there are secondary problems that must be addressed. There are basically four problem areas which include the following: unacceptably high water losses in the distribution system; continued problems with one of the pumps or the well in which the pump is installed; a leaking roof in the main water supply building; and water hardness concerns.

The water distribution system has been experiencing atypically high losses. These losses are likely a result of leaks from the piping in the distribution system or possibly from individuals tapping into the service lines. This situation must be investigated as these losses are unacceptably large and create an unnecessary expense. The following table summarizes the recent water loss data.

Time Period	% Water Loss
12/27/94 - 01/24/95	9%
01/27/95 - 02/22/95	15%
02/25/95 - 03/25/95	24%
03/25/95 - 04/21/95	27%
04/25/95 - 05/24/95	21%
05/24/95 - 06/24/95	17%
06/24/95 - 07/28/95	13%
07/28/95 - 08/25/95	3%
08/26/95 - 09/22/95	9%

There is a continuing problem with one of the two pumps that comprise the Alternate Water Supply System. This pump was replaced once in the past due to the same type of problems and is now experiencing difficulty again. Metal shavings are being observed within the well and the pump excessively vibrates. There have been continuing questions as to whether the problem pertains to the actual pump, the design or installation of the pump, or the design or construction of the well in which the pump is installed. The COE is conducting an ongoing evaluation of this problem.

The roof of the primary water supply building has continued to intermittently leak since construction was completed. Contractors have returned to the building on at least two occasions in order to make repairs to the roof. However, the leaking problem remains and must be corrected. The roof was observed to be leaking during the July 1995 EPA site visit.

The hardness of the water continues to remain an issue with some of the users. The majority of the users are satisfied with the quality of the water and several new users have been

added to the system since construction was completed. However, there have been a relatively small number of individuals who have disconnected from the system because of hardness concerns. A review of the hardness data by KDHE indicates that the quality of the water falls within the upper portion of the normal range for water supply systems within the State of Kansas. The water quality is thus not deemed exceptionally hard as based on the average water quality for the state. The system has alleviated the threat of consumption of metals impacted water. Individuals who desire softened water have the option of installing personal water softener units. While the hardness aspect continues to be a concern to some individuals, no additional response actions appear to be warranted when considering the protectiveness of the current remedy and the comparison to state-wide levels of hardness. The recent hardness data is provided below.

Time Period	Hardness (CaCO₃)
April 1995	374 ppm
May 1995	400 ppm
June 1995	410 ppm
July 1995	405 ppm
August 1995	410 ppm

CaCO₃ = Calcium Carbonate

ppm = parts per million or micrograms per kilogram (ug/kg)

6.0 STATEMENT OF PROTECTIVENESS

Operation of the Alternate Water Supply System since May 1993 has established that the system was constructed within the desired specifications and that the remedy is operational and functional. The basis for this determination is that good quality water is being supplied to the residents of rural Galena, Kansas so the potential health threat from drinking contaminated shallow aquifer water has been corrected. Therefore, the remedy selected continues to protect the public health, welfare, and the environment.

7.0 RECOMMENDATIONS

The alternate water supply continues to provide an adequate source of drinking water to users. The following recommendations are the result of this review.

- * Evaluate and correct the excessive water losses that are occurring.
- * Evaluate and correct the problems with the pump, installation or design of the pump, or the well.
- * Evaluate and correct the problems with the leaking roof.

- * Continue to monitor concerns related to hard water and provide information on personal water softeners and information on water systems in the State of Kansas as a whole.

8.0 NEXT REVIEW

Since hazardous substances, pollutants or contaminants remain at the site at levels above the cleanup standards established for this remedial action, and at levels which will not allow for unlimited use or restricted exposure, the EPA will conduct additional Five-Year Reviews. According to guidance from EPA headquarters, this statutory Five-Year Review should have been conducted in September 1994 since the beginning of the physical construction of the water tanks under this remedial action began in September 1989. The EPA Region VII will follow the guidance for the schedule of the next review which should be completed within five years after September 1994 - in September 1999.